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ABSTRACT

This document is an instructional module package prepared in objective form for use by an instructor familiar with the laboratory procedures for determining the complete series of solids analyses on wastewater and wastewater sludge samples. Included are objectives, instructor guides, student handouts and transparency masters. This module considers total solids, total volatile solids, total suspended solids, volatile solids, dissolved solids, settleable solids, percent solids and percent volatile solids. (Author/BB)

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SOLIDS ANALYSIS

Training Module 5.100.2.77

Prepared for the

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September, 1977

SE 024 161

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Module No:	Module Title:
	Solids Analysis
Approx. Time:	Topics: Introduction Total Solids and Total Volatile Solids Introduction to Suspended Solids Total Suspended Solids - Volatile Suspended Solids Dissolved Solids Settleable Solids Tests Percent Solids and Percent Volatile Solids in Sludge

Objectives:

When the participant completes this module they should be able to:

1. Conduct a complete set of solids analysis on wastewater and sludge.
2. Differentiate between the tests and between the tests as used on wastewater and sludge.

Instructional Aids:

Handouts

Instructional Approach:

Lecture
Lab

References:

Standard Methods, 14th Edition
EPA Effluent Monitoring Procedures
EPA - Methods for Chemical Analysis of Water and Wastes
Carnegie & Wooley Laboratory Manual for Sanitary Microbiology and Chemistry

Class Assignments:

Instructional Aids

EPA slide-tape is available from:

Eileen Hopewell
National Training Center
Water Programs Operation
Vine & St. Claire St.
Cincinnati, Ohio 45268

Overheads

Typed overheads are an example of overhead layout and content. For classroom use the overhead should be constructed using colored, 1/4 inch dry transfer letters.

Other overheads may be copied directly.

Handouts

Handouts may be copied directly.

Lab supplies and apparatus

Supplies and apparatus should be supplied per handouts so that participants may work in groups of 2 or 3.

Module No:	Module Title:
	Submodule Title:
Approx. Time:	Topic: Introduction to Solids Analysis

Objectives:

When the participants complete this topic they should be able to:

1. Indicate five types of solids tests used in the analysis of wastewater and two types of solids tests run on wastewater sludges.
2. Differentiate between solids tests as run on wastewater and sludges.
3. Identify the accepted units of expression for reporting results of solids tests run on wastewater and on sludges.
4. Identify the terms used for the solids tests in Standard Methods.

Instructional Aids:

Overheads

Instructional Approach:

Lecture

References:

Standard Methods
EPA - EMP
EPA - Methods

Class Assignments:

Module No:	Topic: Introduction

Instructor Notes:	Instructor Outline:
Overhead Page 7	1. List and briefly describe the wastewater solids tests and the sludge solids tests. Wastewater Total solids Total volatile solids Total suspended solids Total volatile suspended solids Settleable solids Sludge Total solids Total volatile solids
	2. Indicate that wastewater solids tests are a volume/weight relationship and sludge solids tests are a weight/weight relationship.
	3. Indicate that wastewater solids results are reported in mg/l and sludge solids results are reported as percent solids.
Overhead Page 8 & 9	4. Explain that Standard Methods and some EPA methods use the word residue in place of solids and filterable for suspended.

OVERHEAD

WASTEWATER

TOTAL SOLIDS

TOTAL VOLATILE SOLIDS

TOTAL SUSPENDED SOLIDS

TOTAL VOLATILE SUSPENDED SOLIDS

SETTLEABLE SOLIDS

SLUDGE

PERCENT SOLIDS

PERCENT VOLATILE SOLIDS

OVERHEAD

SOLIDS - RESIDUE

TOTAL SOLIDS

SAME AS

TOTAL RESIDUE

OVERHEAD

SUSPENDED - FILTERABLE

SUSPENDED SOLIDS

SAME AS

FILTERABLE RESIDUE

Module No:	Module Title:
	Submodule Title:
Approx. Time:	Topic: Total Solids - Total Volatile Solids - Wastewater

Objectives:

When the participants complete this topic they should be able to:

1. Identify proper apparatus needed for the total solids and total volatile solids test.
2. Obtain and prepare a proper sample for the test.
3. Conduct a total solids and volatile total solids test given proper test equipment, procedures sheet and proper sample material.
4. Translate the raw data from both tests into proper units of expression given appropriate conversion factors and equations.

Instructional Aids:

Handouts

Instructional Approach:

Lab

References:

Manual for Sanitary Chemistry and Sanitary Microbiology

Class Assignments:

Conduct a total solids and volatile solids test

Module No:	Topic: Total Solids

Instructor Notes:	Instructor Outline:
Page 12	1. List and identify the apparatus needed for the total solids and total volatile solids test.
	2. Discuss sampling for solids tests.
Page 12 - 15 Pages 16 - 17	3. Demonstrate the key points of a total solids and volatile solids test. Weighing Adding sample Cooling and re-weighing Evaporation and drying Use of muffle furnace Cooling and re-weighing
	4. Work sample problems using data from the tests. Have participants determine results using their raw data.

TOTAL SOLIDS

Introduction

Total Solids are all solids including suspended, settleable and dissolved. The measurement is made by driving the water off a known amount of sample and weighing the residue.

Equipment

Analytical balance--reading to 0.1 mg

Steam bath table

Porcelain evaporating dish

Evaporating dish holder

Graduated cylinder--100 ml

Plastic wash bottle with distilled water

Desiccator

Drying oven set at 103° C

Asbestos pad

Preliminary Procedure

1. CLEAN THE EVAPORATING DISH.

   Dishes which are dirty should be soaked in a chromic acid cleaning solution. Wearing rubber gloves, scrub the dishes with steel wool. Rinse with water. Wash with hot, soapy water and rinse thoroughly. Give the dishes a final distilled water rinse.

2. PLACE DISH IN 103° C OVEN.

   Dishes which are clean should be stored in the oven until they are needed for an experiment.

Testing Procedure

1. REMOVE DISH FROM OVEN WITH HOLDER.

   Allow to cool on asbestos pad for a few minutes. From this point on, handle the dish with holder. Do not touch the dish with your fingers.

2. PLACE DISH IN DESICCATOR.

   Leave dish in desiccator for 30 minutes.

3. WEIGH DISH ON ANALYTICAL BALANCE TO FOUR DECIMAL PLACES.

   Once the dish is removed from the desiccator, it should be placed on the balance and weighed immediately. Try to establish a regular pattern in your methods of handling porcelain dishes and crucibles from the oven to desiccator to balance to minimize errors in weighing due to moisture pick-up and loss. Record the weight as "dish weight".

4. REMOVE DISH FROM BALANCE AND PLACE ON ASBESTOS PAD.

5. PLACE SAMPLE IN DISH.

   Mix and pour a 100 ml sample into a 100 ml graduated cylinder. Add the sample to the pre-weighed evaporating dish.

6. PLACE THE DISH WITH SAMPLE, ON THE STEAM TABLE.

   Remove one or two of the rings from one of the spaces on the table to allow the evaporating dish to sit half way down into the steam table top. The steam table should be on and producing steam before the dish is placed on top.

7. ADJUST THE WATER FLOW THROUGH THE STEAM TABLE.

   A small amount of water should trickle out the overflow pipe at all times. CAUTION: Make sure the table does not go dry or the heating element may burn out.

8. REMOVE THE DISH FROM THE TABLE.

   Remove dish from evaporating table when completely dry. Remember to use the holder.

9. PLACE THE DISH IN THE 103° C OVEN FOR 30 MINUTES.

10. REMOVE THE DISH AND ALLOW IT TO COOL,

    on an asbestos pad for a few minutes.

11. PLACE DISH IN DESICCATOR FOR 30 MINUTES.

12. REMOVE AND WEIGH,

    as rapidly as possible to four decimal places on the analytical balance. Record the weight as "dish plus sample weight".

Calculations

Example:		
	Dish plus sample weight	66.8452 g
	Dish weight	- 66.7800 g
	Sample weight	0.0652 g

If the sample volume is always kept at 100 ml as it should be, then in order to convert the calculated sample weight in the example to mg/l simply move the decimal point four places to the right. Thus the value of 0.0652 g would be expressed as 652 mg/l. To convert grams to mg multiply by 1000.

The general equation is:

$$\text{Total Solids, mg/l} = \frac{\text{sample weight, mg}}{\text{sample size, l}}$$

Example: $$\text{Total Solids, mg/l} = \frac{65.2 \text{ mg}}{0.1 \text{ l}}$$

$$= 652 \text{ mg/l}$$

Notes

1. The use of steam table assures a smooth, gentle heating procedure which does not drive off any of the volatile components of the wastewater sample. The procedure does take time but is the recommended procedure. Do not use a bunsen burner or an electric stove to evaporate samples.
2. A good procedure to speed up the weighings is to number the dishes with porcelain ink. Use a vibrating engraving pencil to break the porcelain glaze on the side of the dishes and trace out a number or letter. Rub in porcelain ink and remove extra ink. Keep a record sheet of the marked dishes empty weights above the balance. Each time an experiment is to be run, a particular dish's weight can be placed on the balance and the final reading can be speeded up as compared with starting from scratch each time.
3. Once a porcelain dish or crucible develops a crack and is no longer useful for the solids tests, throw it away.

VOLATILE TOTAL SOLIDS

Introduction

Volatile solids are those solids which can be burned at 600° C. This represents essentially the total organic content of the sample.

After the final weighing of the evaporating dish for the total solids tests, the sample can be heated to burn off the volatile organic sample material and the residue weight determined.

Equipment

Asbestos glove

Tongs

Muffle furnace

Procedure

1. PLACE DISH PLUS SAMPLE IN MUFFLE FURNACE.

   Ash the sample for 60 minutes at 600° C. Use the glove and long tongs. Do not exceed 600° C. in temperature. Remember the sample is the residue from the total solids test.

2. REMOVE THE DISH FROM THE FURNACE.

   Allow it to cool on the asbestos pad for 15 minutes.

3. PLACE DISH IN DESICCATOR.

   Use dish holder. Leave dish in desiccator for 30 minutes.

4. WEIGH DISH ON ANALYTICAL BALANCE.

   Weigh as rapidly as possible to four decimal places. Record weight as "dish plus ash weight".

Calculations

Example: Dish plus sample weight (from total solids test) 66.8452 g

Dish plus ash weight - 66.7943 g

Ash weight (Volatile Total Solids) 0.0509 g

If original sample was 100 ml, then volatile total solids would equal 509 mg/l. Again, the sample volume is that from the total solids test. To convert grams to mg multiply by 1000.

$$\text{Ash weight, mg/l} = \frac{\text{ash weight, mg}}{\text{sample volume l}}$$

Example: $$\text{Ash weight, mg/l} = \frac{50.9 \text{ mg}}{0.1 \text{ l}}$$

$$= 509 \text{ mg/l}$$

Module No:	Module Title:
	Submodule Title:
Approx. Time:	Topic: Introduction to Suspended Solids Analysis - Introduction

Objectives:

When the participants complete this topic they should be able to:

1. Differentiate between the gooch crucible method and glass fiber filter apparatus method.

Instructional Aids:

Handout

Instructional Approach:

Lecture

References:

Standard Methods

Class Assignments:

Module No:	Topic: Introduction to Suspended Solids

Instructor Notes:	Instructor Outline:
	1. a. Discuss the suspended solids analysis procedure. b. Differentiate between the gooch crucible method and the glass fiber filter method. c. List advantages and disadvantages of each method. Glass fiber method 1. Larger sample size Gooch crucible method 1. Less filter handling

Module No:	Module Title:
	Submodule Title:
Approx. Time:	Topic: Total Suspended Solids - Total Suspended Volatile Solids

Objectives:

When the participants complete this topic they should be able to:

1. Identify the proper apparatus needed for the total suspended solids test (TSS) and total suspended volatile solids test (TSVS).
2. Obtain and prepare a proper sample for the TSS and TSVS test.
3. Conduct a TSS test and TSVS test given proper test equipment, procedures sheet and proper sample material.
4. Translate the raw data from the two tests into proper units of expression given appropriate conversion factors and equations.

Instructional Aids:

Handout
Lab equipment

Instructional Approach:

Lab

References:

Manual for Sanitary Chemistry and Sanitary Microbiology

Class Assignments:

Module No:	Topic: Total Suspended Solids - Total Suspended Volatile Solids

Instructor Notes:	Instructor Outline:
Page 22	1. List and identify the proper apparatus needed for the TSS and TSVS test.
Pages 22 - 25	2. Discuss sampling and indicate that procedures are the same as for the total solids test.
Pages 26 - 27	3. a. Demonstrate the starting and ending of the two tests. b. Explain that a TSS test is part of the TSVS test and the same sample and filter is used in the TSS test. c. Have participants complete the two tests.
Page 25 Page 27	4. a. Work sample problems converting raw data into proper units of expression. b. Have participants convert their raw data into proper units of expression. Discuss the determination of dissolved and volatile dissolved solids given total volatile suspended and volatile suspended solids data. Discuss the alternative test procedure for dissolved solids.

SUSPENDED SOLIDS

Introduction

Suspended solids are those solids which can be trapped on a glass fiber filter. By this definition suspended solids will also include settleable solids. The suspended solids test is one of the primary criteria used to evaluate effluent quality. A well run trickling filter plant should operate below 30 mg/l and an activated sludge plant below 10 mg/l suspended solids in final effluent.

Equipment

Gooch filtering crucible, 25 ml size

Glass fiber filters--2.4 cm in diameter

500 ml glass filter flask

Rubber collar and glass stem for vacuum filtering

Rubber vacuum tubing

Vacuum source--either mechanical pump or water faucet aspirator vacuum

Forceps

50 ml and 100 ml graduated cylinders

Crucible tongs

Desiccator, either glass or front door type

Analytical balance--reading to 0.1 mg

Drying oven set at 103^{0} C.

Asbestos pad

Plastic wash bottle with distilled water

Preliminary Procedures

1. CLEAN THE CRUCIBLE WITH HOT WATER AND DETERGENT.

   Rinse thoroughly with a final rinse in distilled water.

2. PLACE CRUCIBLE IN 103° C. OVEN.

   From this point on use tongs.

Testing Procedure

1. PLACE GLASS FIBER FILTER IN CRUCIBLE.

   Use forceps. Make sure rough side of filter is up. The smooth side generally has small grid marks visible. There is an obvious difference between the two sides if one looks closely.

2. WASH THE FILTER.

   Using the plastic wash bottle, wet the filter thoroughly while applying gentle vacuum. Wash the filter with 100 ml distilled water.

3. DRY CRUCIBLE AND GLASS FILTER.

   For 1 hour at 103° C. Crucibles which are clean should be stored in the oven until they are needed for an experiment. The crucibles should be marked as outlined for porcelain dishes in the Total Solids test.

4. PLACE CRUCIBLE PLUS FILTER IN DESICCATOR.

   For 30 minutes.

5. WEIGH ON ANALYTICAL BALANCE.

   Record weight to four decimal places as "crucible plus filter weight".

7. SET UP FILTRATION APPARATUS.

   Connect to vacuum source.

8. PLACE CRUCIBLE PLUS FILTER ON RUBBER COLLAR.

   First place rubber collar and glass stem into filtering flask. Use tongs and/or a piece of toweling to seat the crucible. Don't touch crucible with fingers.

9. SEAT THE GLASS FILTER WITH VACUUM.

   Make sure all holes in crucible are covered. Wet the filter with distilled water using the wash bottle.

10. WITH VACUUM ON, APPLY SAMPLE.

    See note at end of procedure regarding sample size, suggestions.

11. RINSE THE CRUCIBLE AND GLASS FILTER.

    Use distilled water to wash sidewall solids down onto the glass filter and remove any soluble solids trapped in the glass filter.

12. REMOVE CRUCIBLE AND PLACE IN OVEN.

    Dry for 60 minutes at 103° C. Use tongs and toweling again. Carry crucible with asbestos pad underneath using crucible tongs.

13. REMOVE FROM OVEN

    Cool for a few minutes.

14. PLACE IN DESICCATOR FOR 30 MINUTES.

15. WEIGH ON ANALYTICAL BALANCE.

    Weigh to four decimal places and record weight as "crucible plus filter plus sample".

Calculations

Example: Crucible plus filter plus sample 22.6501 g

Crucible plus filter - 22.6345 g

Sample 0.0256 g

$$\text{Suspended Solids, mg/l} = \frac{\text{sample weight, mg}}{\text{sample volume}\ \ 1}$$

Example: For 100 ml sample

$$\text{Suspended Solids, mg/l} = \frac{25.6\ \text{mg}}{0.1\ \ 1}$$

Remember to convert grams to mg multiply by 1000.

Notes

Some operators have found it more convenient to use a 600-ml fritted-glass Buchner Funnel Grade C porosity and 9 cm glass fiber filter rather than the Gooch Crucible. This alteration allows the filtration of a larger sample volume and thus better accuracy.

The buchner funnel method or glass fiber filter method is the recommended method for mixed liquor solids.

Suggested sample size for Suspended Solids

Type of Sample	ml of sample Using Gooch Crucible	Using Buchner Funnel
Raw Sewage	2-25 ml	50-200 ml
Primary effluent	50 ml	200 ml
Final effluent	100 ml	1000 ml

VOLATILE SUSPENDED SOLIDS

Introduction

That portion of the suspended solids which can be burned off at 600° C. is the volatile suspended solids. This value is considered to represent the organic load on the plant and is used more frequently than Volatile Total Solids.

After the final weighing of the crucible for the suspended solids test, the sample can be heated to burn off the volatile suspended organic. Sample material and the residue weight determined.

Equipment

Asbestos glove

Tongs

Muffle furnace

Procedure

1. PLACE CRUCIBLE PLUS FILTER PLUS SAMPLE IN MUFFLE FURNACE.

   Use the asbestos glove and long tongs. Ash the sample for 60 minutes at 600° C. Do not exceed 600° C.

2. REMOVE THE CRUCIBLE FROM THE FURNACE.

   Allow it to cool on the asbestos pad for 15 minutes.

3. PLACE CRUCIBLE IN DESICCATOR.

   Use crucible tongs, leave the crucible in desiccator for 30 minutes.

4. WEIGH CRUCIBLE ON ANALYTICAL BALANCE.

   Weigh as rapidly as possible to four decimal places. Record weight as "crucible plus ash weight".

Example: Using a 50 ml sample

Crucible plus filter plus sample (from Suspended Solids Test)	22.6501 g
Crucible plus ash weight	- 22.6451 g
Volatile suspended solids	0.0050 g

Remember: Sample Volume is from Suspended Solids Test. To convert grams to mg multiply by 1000.

$$\text{Volatile Suspended Solids, mg/l} = \frac{\text{weight of volatile suspended solids, mg}}{\text{sample volume, l}}$$

Example: $$\text{Volatile Suspended Solids, mg/l} = \frac{5.0 \text{ mg}}{0.050 \text{ l}}$$

$$= 100 \text{ mg/l}$$

Percent Volatile Solids

To calculate the percent volatile suspended solids in the sample use the following formula:

$$\% \text{ vol. sus. solids} = \frac{\text{mg/l vol. sus. solids}}{\text{mg/l suspended solids}} \times 100$$

$$\% \text{ vol. sus. solids} = \frac{100 \text{ mg/l}}{256 \text{ mg/l}} \times 100$$

$$= 39\%$$

Module No:	Module Title:
	Submodule Title:
Approx. Time:	Topic: Dissolved Solids Test

Objectives:

When the participant completes this topic they should be able to:

1. Determine the amount of volatile dissolved solids and total dissolved solids in a sample given total suspended solids, total volatile suspended solids, total solids and total volatile solids data.

Instructional Aids:

Handout

Instructional Approach:

Lecture

References:

Standard Methods

Class Assignments:

Module No:	Topic:

Instructor Notes:	Instructor Outline:
Page 30	Demonstrate how to use total and suspended solids data to determine dissolved solids. Indicate that the same sample must have been used for each test. Have class use their data to determine the dissolved solids and volatile dissolved solids data for their sampoes.

DISSOLVED SOLIDS

Introduction

This test is nothing more than a calculation. If one subtracts the suspended solids value from the total solids value, the result is termed Dissolved Solids.

Calculations

Dissolved Solids, mg/l = Total Solids, mg/l - Suspended Solids, mg/l

Example: Dissolved Solids, mg/l = 652 mg/l - 256 mg/l

= 396 mg/l

Module No:	Module Title:
	Submodule Title:
Approx. Time:	Topic: Settleable Solids Test

Objectives:

When the participants complete this topic they should be able to:

1. Identify proper apparatus needed for the settleable solids test.
2. Obtain and prepare a proper sample for the settleable solids test.
3. Conduct a settleable solids test given proper test equipment, procedures sheet and proper sample material.
4. Translate the raw data from the settleable solids test into proper units of expression.

Instructional Aids:

Handout

Instructional Approach:

Lecture
Lab

References:

Manual for Sanitary Chemistry and Sanitary Microbiology

Class Assignments:

Module No: –	Topic: Settleable Solids Test

Instructor Notes:	Instructor Outline:
Pages 33 & 34	1. List and identify the apparatus needed for the settleable solids test. 2. Discuss sampling. 3. Demonstrate the setup of the test. 4. Discuss data reporting Have participants report the results from their tests.

SETTLEABLE SOLIDS

Introduction

Settleable solids are defined as the solids which will settle out in an Imhoff cone in 60 minutes. This quantity of solids is intended to relate to solids removal in the primary sedimentation process.

Equipment

One liter glass Imhoff cones--broad tip.

Stand to hold glass cones upright.

Procedure

1. PLACE CONE IN STAND.

   Make sure the cone is clean and has no deposits in the bottom tip.

2. MIX AND POUR SAMPLE.

   Mix and pour as rapidly as possible a one liter volume up to the mark on the side of the cone.

3. LET THE SAMPLE SIT FOR 45 MINUTES UNDISTURBED.

   After 45 minutes, rotate the cone back and forth two or three times to jar loose any large particles attached to the sides of the cone.

4. LET THE SAMPLE SIT AN ADDITIONAL 15 MINUTES (60 MINUTES TOTAL).

5. READ THE VOLUME OF SETTLEABLE SOLIDS.

   The graduated scale is located on the bottom of the cone. Data is recorded as ml/l (milliliter/liter). Note: If the settleable solids do not pack down completely under the force of gravity, there may be some water trapped in between layers of solids in the bottom of the cone. It will then be necessary to estimate the amount of water and subtract

the water value to obtain the total settleable solids volume. Do not attempt to pack the sample or release the trapped air with a stirring rod.

Module No:	Module Title:
	Submodule Title:
Approx. Time:	Topic: Percent Total Solids in Sludge & Percent Volatile Solids in Sludge

Objectives:

When the participants complete this topic they should be able to:

1. Identify proper apparatus needed for the percent total solids and percent volatile solids in sludge.
2. Obtain and prepare a proper sample for the percent total solids test.
3. Conduct a percent total solids and a percent volatile solids in sludge test given proper test equipment, procedures sheet and proper sample material.
4. Translate the raw data from the percent total solids and percent volatile solids test given.

Instructional Aids:

Handout

Instructional Approach:

Lab

References:

Manual for Sanitary Chemistry and Sanitary Microbiology

Class Assignments:

Module No:	Topic: Percent Total Solids in Sludge & Percent Volatile Solids in Sludge

Instructor Notes:	Instructor Outline:
Pages 37 - 39	1. List and identify the apparatus needed for the percent total solids and volatile percent total solids in sludge tests. 2. Discuss sampling and how it differs from wastewater sampling. 3. Demonstrate the first portions of both procedures. Have students translate their raw data into percents. Work examples if necessary.

Introduction

Total Solids are all solids material in a sample. Measurement is made by driving of water from a known weight of sample sludge and weighing the dried volatile solids are determined by igniting the dried sample in a 600° C. furnace, cooling and weighing the ash.

Equipment

Balance - reading to .01 gram

Steam bath

Porcelain evaporating dish

Tongs

Desiccator

Drying oven

600° muffle furnace

TOTAL SOLIDS IN SLUDGES

A. Preparation of Porcelain Dish

1. Wash dish with soap and water
2. Rinse thoroughly with water
3. Rinse with distilled water
4. Dry dish
5. Place in muffle furnace at 550° C. for 5 - 10 minutes
6. Place in desiccator for 1 hour

NOTE: DO NOT HANDLE DISH WITH HANDS. USE FORCEPS.

B. Test Procedure

1. Weigh the dish using analytical balance (weight of dish), 3 spaces provided.
2. Record weight
3. Pour a sample of well mixed sludge into the dish.
4. Weigh the dish and wet sample.
5. Record the weight.
6. Place dish + sample into drying oven 103 - 105° C. for 12 hours or until dry or place dish in steam bath to remove water in the drying oven.
7. Place dish + sample in desiccator until cool.
8. Weigh dish + sample and record in proper space.
9. Place dish + dry sample in muffle furnace at 600° C. for 10 - 15 minutes.

NOTE: The concentration of sludge determines the length in the muffle furnace.

10. Place dish and ignited sample in desiccator.
11. Allow to cool.
12. Weigh dish and sample.
13. Record in proper space.
14. Calculate % total solids, % fixed solids, and volatile solids.
15. Wash dish with soap and water.
16. Rinse thoroughly with water.
17. Rinse with distilled water.

18. Dry dish
19. Ignite dish in muffle furnace.
20. Store clean dish in desiccator.

Module No:	Topic: EVALUATION
Instructor Notes:	Instructor Outline:
	Demonstrate the successful completion of any 3 of the following tests. Total solids Total suspended solids Volatile suspended solids Percent solids in sludge Percent volatile solids